

CHAPTER 2

ADDRESSING NONPOINT SOURCES

2.1 OVERVIEW OF MONTANA'S GEOGRAPHY AND LAND USES

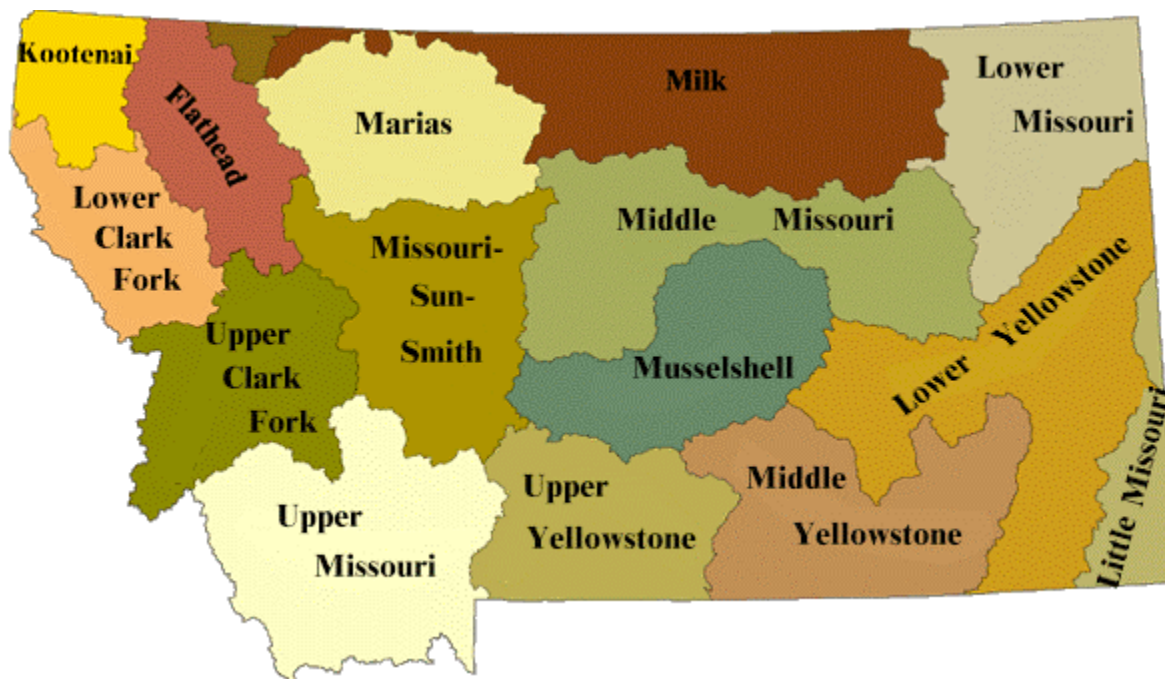
At 145,388 square miles—93 million acres—Montana is a big state. Were the state's 902,195 residents spread evenly across the land, there would only be six persons per square mile. Of course, people are not scattered uniformly. Sixty percent live in just seven of the 56 counties. Thirty-six percent live in eight cities. Six of the seven most populous counties and six of the eight largest cities are located in western Montana where recent growth has been rapid. This concentration of population leaves much of the state with a very low population density.

Almost a third of Montana is owned by the state and federal government: 17 million acres managed by the U.S. Forest Service, mostly in the western half of the state; 8 million acres administered by the Bureau of Land Management and lesser acreage controlled by the National Park Service and other agencies. The state owns more than six million acres, most of it managed by the Department of Natural Resources. There are seven Indian reservations totaling 2.5 million acres. Agriculture, recreation and tourism, forest products, and mining form the base of Montana's economy. The eastern third of Montana is prairie land, part of the Northern Great Plains ecosystem. The middle third is prairie surrounding island mountain ranges. Western Montana is characterized by rugged mountain ranges and deep river valleys. Generally speaking, precipitation decreases from west to east and varies from 80 inches in the high western mountains to less than 10 inches in the northeastern plains.

Montana has been called the "Headwaters of the Continent." It is the only state that sends water to three oceans. The state is comprised of three major and two minor river basins:

- Two tributaries of the **Columbia**, the Clark Fork and the Kootenai, drain 26 million acre feet from 25,125 square miles. This basin is just 17 percent of the land area but accounts for 53 percent of the state's annual surface flow.
- Conversely, the **Missouri** and its tributaries drain 56 percent of the state, over 82,000 square miles, yet only carries 17 percent of the annual surface flow (8 million acre feet).
- The **Yellowstone** drains 36,000 square miles (24 % of the state) and carries 9.5 million acre feet (21%) to meet the Missouri just inside the North Dakota border.
- The **Little Missouri River** slips through the southeast corner of the state draining just two percent of the land area in Montana.
- The **St. Mary's River** flows north toward the Arctic Ocean from Glacier National Park, draining two percent of the water from one percent of the land.

For management purposes, these five river basins are divided into 16 major sub-basins (Figure 2-1) which are further divided into 91 watershed planning areas.

Figure 2-1: 16 Major River Basins

2.1.1 Overview of Beneficial Uses of Surface Waters, the Water Classification System, and Water Quality Standards in Montana

The Montana Water Quality Act requires the Board of Environmental Review to adopt water quality standards to protect beneficial uses. The act also directs the Board to establish permit and nondegradation requirements. Surface and groundwater use classifications systems and water quality standards and criteria are defined in the Administrative Rules of Montana, Title 17, Chapter 30, Subchapters 6 and 10, respectively.

For most rivers, lakes and streams “beneficial uses” are those uses which the water body supported when the classification system was adopted in 1955. Beneficial uses can be group in three broad categories: aquatic life support, recreation and water supply.

Aquatic life includes the plants and animals normally associated with a high quality ecosystem. Fisheries use is a more focused element of aquatic life support. Aquatic life support may be impaired by chemical pollutants, sediment, riparian habitat degradation, stream channel modifications, excessive water withdrawal for irrigation and other actions that disrupt the integrity of the waterbody.

Recreation uses includes activities that involve contact with water such as swimming and boating. Recreation use may be impaired by noxious algae growth or health concerns such as fecal coliform bacteria.

Water supply encompasses domestic, municipal, industrial and agricultural uses. Low flow, excessive sediment and suspended solids and high salinity may impair water supply uses.

Aquatic life support, fisheries, swimming and drinking water supply have the highest water quality requirements. When these uses are fully supported it is reasonable to expect that other uses (such as agriculture water supply) will also be supported.

Four levels of beneficial use support describe Montana's waters:

1. **Fully supporting:** waters are at their natural or best practical condition and water quality standards are not being violated.
2. **Threatened but fully supporting:** there is a downward trend in water quality or a new activity or an increase in existing activities not using BMPs that may result in violations of water quality standards.
3. **Partially supporting:** This is a broad designation for situations in which a waterbody is in the range between "slightly impaired" to "barely supporting" a designated use.
4. **Non-supporting:** a waterbody has acute toxics or human health criteria violations, where biological or physical data indicate severe degradation, or where other data indicate that water quality standards are violated and one or more uses cannot be attained.

Waterbodies are assessed for each beneficial use. A lake or stream segment might be fully supporting one use, such as industrial water supply, while only partially supporting another use, such as aquatic life.

Montana classifies waterbodies as:

A- very high quality waters suitable for public water supply.

B- suitable for multiple uses including domestic supply after conventional treatment. The B classification is divided into cold water fisheries, commonly mountain or foothill streams and lakes that support trout and associated fish (B-1 & B-2); and eastern prairie waters that typically support sauger, catfish and other warm water fish species (B-3). Most Montana rivers and streams are classified as B-1, B-2 or B-3.

C- suitable for all uses except drinking water; four stream segments are classified as C-1 and C-2 due to contaminants identified prior to 1955. C-3 waterbodies are naturally high in total dissolved solids.

I- waterbodies which were impaired in 1955. There are only three I stream segments and one of these, Muddy Creek in the Sun River watershed, is being restored by a local watershed group (see page 3-3).

Wetlands

Wetlands protect water quality by storing flood water, trapping sediment, filtering out pollutants and utilizing nutrients. Wetlands recharge aquifers. Many fish and wildlife species rely on wetlands including threatened and endangered species such as whooping cranes, piping plovers, and bald eagles. The prairie pothole region of the northern Great Plains provides valuable production areas for waterfowl. Montana wetlands support the tourism industry by providing fishing, hunting, camping, and wildlife viewing opportunities.

Montana classifies wetlands as waters of the state, which affords them the level of protection afforded other surface waters. The state is still developing water quality standards and a baseline inventory and tracking system for wetlands. DEQ has been appointed the lead agency for wetland management. Wetlands comprise less than one percent of the total surface area of Montana. It has been estimated that 27 percent of Montana's wetlands have been lost since colonial times.

2.1.2 Major Sources and Causes of Nonpoint Source Pollution

Section 303(d) of the Federal Clean Water Act requires states to identify waters where beneficial uses are either impaired or threatened. The state's 303(d) list also identifies probable sources and causes of impairment. The cause of an impairment is the contaminant, the source is where the contaminant came from. For example, the cause of impairment might be heavy metals. The source may be an abandoned landfill. The leading causes of stream impairments are habitat

modification (bank erosion, channel incisement, riparian degradation and fish habitat degradation), siltation, flow alteration, excess nutrients, salinity, metals and suspended solids. Lakes are impaired by siltation, metals, nutrients, flow alterations, suspended solids, habitat alteration and salinity.

Nonpoint source pollution accounts for 90 percent of stream and 80 percent of lake impairments in Montana. More than half the land area of Montana is devoted to ranching and farming (see Figure 2-2). So it follows that agriculture is one of the leading sources of NPS pollution (Table 2-2). Hydrological modifications, resource extraction, construction, forestry, urban runoff, septic systems, landfills and other activities also impact water quality. Table 2-1 and Table 2-2 compares Montana's sources of water impairments to the nation as a whole.

Several sources can contribute to a particular impairment (Figure 2-3). For example, siltation in a stream may be the result of agriculture soil erosion, construction, and timber harvest practices in different parts of the same watershed. More detailed assessments, such as those conducted for the TMDL development process, will be required to determine how much sediment is contributed by each source and how much is from natural background sources.

Over 50 percent of Montanans get their domestic water supply from groundwater sources. Groundwater in Montana has become contaminated by some of the same causes and sources as surface waters. For example, groundwater and public water supply wells have been contaminated with nitrates, bacteria, solvents, benzene, cyanide, pesticides, and salts contributed by septic systems, industrial wastewater disposal, leaking underground storage tanks, mining, and agricultural practices.

The interaction between aquifers and surface water is very dependent on local conditions. Due to the widespread dependence on groundwater for drinking water in Montana, attention to this flow exchange between ground and surface water has been increasing. Groundwater contamination has been attributed to surface water quality at two sites in Montana. Near Three Forks concentrations of arsenic increased in the alluvial aquifer after sprinkler irrigation systems replaced flood irrigation. The increased efficiency of

Figure 2-2: Montana Nonfederal Rural Land

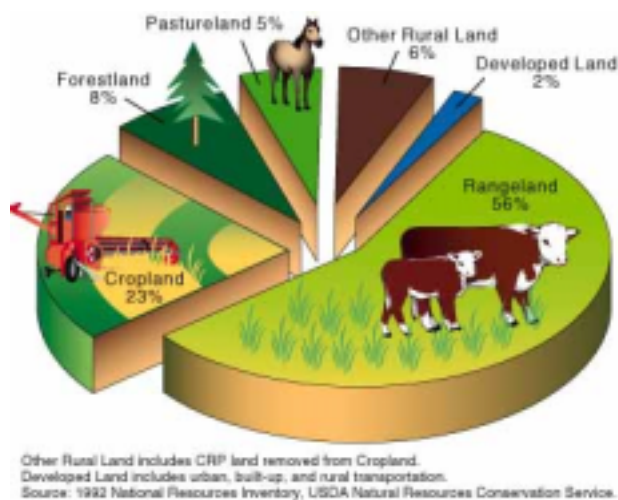
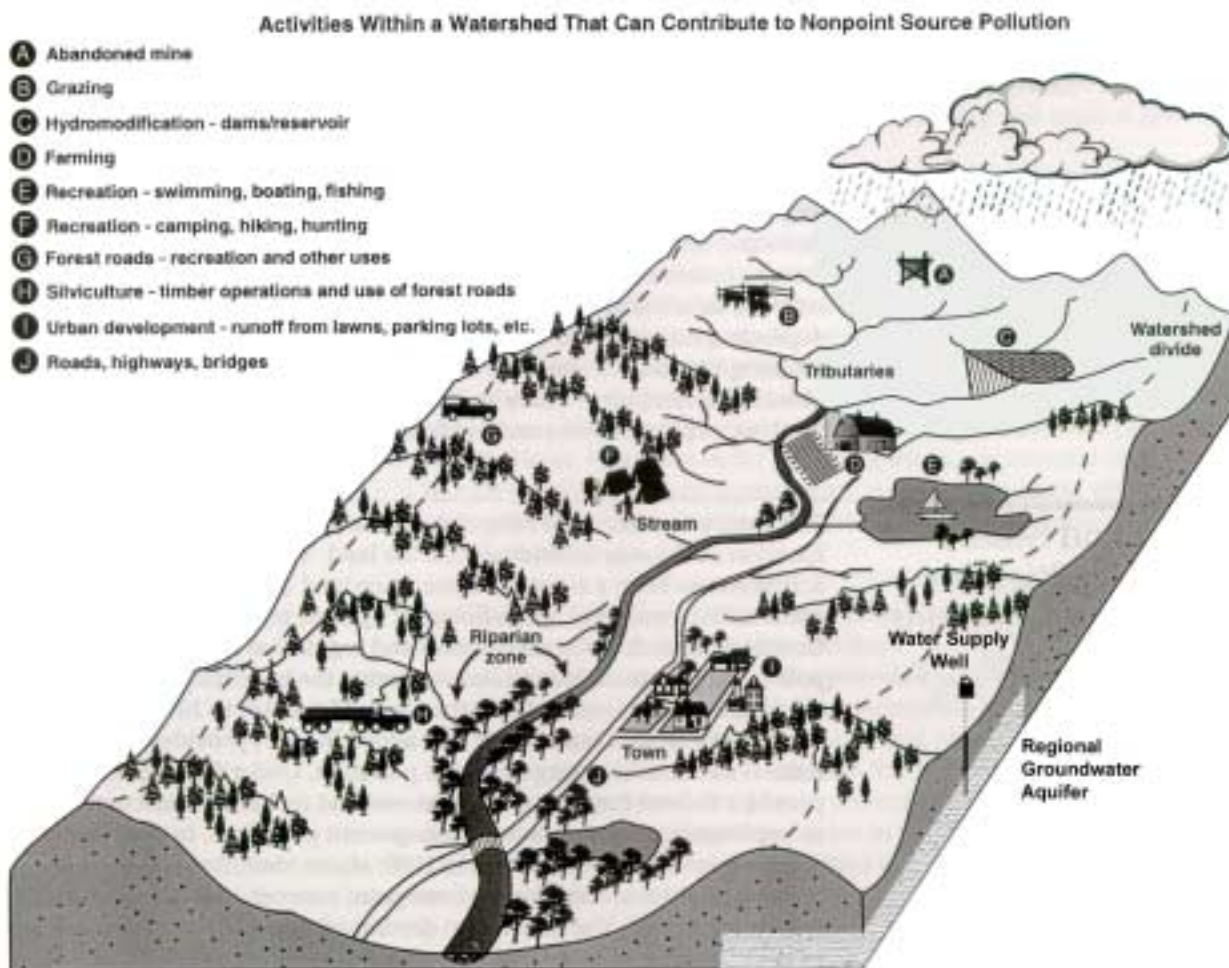


Figure 2-3



Source: GAO/RCED-99-45 Nonpoint Source Pollution

Table 2-1: Five Leading Sources of Water Quality Impairment—U.S.

Rank	Rivers	Lakes
1	Agriculture	Agriculture
2	Municipal Point Sources	Unspecified Nonpoint Sources
3	Hydrologic Modification	Atmospheric Deposition
4	Habitat Modification	Urban Runoff/Storm Sewers
5	Resource Extraction	Municipal Point Sources

Source: 1996 National Water Quality Inventory

Table 2-2: Five Leading Sources of Water Quality Impairment-Montana

Rank	Rivers & Streams	Lakes
1	Agriculture	Atmospheric Deposition
2	Hydrologic Modification	Agriculture
3	Resource Extraction	Resource Extraction
4	Habitat Modification	Debris and Bottom Deposits
5	Construction	Hydrologic Modification

Source: **Montana 303(d) List**, November 2000

sprinkler irrigation probably reduced dilution and increased the concentration of naturally-occurring arsenic in ground water. At Milltown, arsenic and heavy metal concentrations in the alluvial aquifer have increased as a result of river water being pushed by hydraulic pressure through the mill tailing sediments behind Milltown Dam.

The 1999 Montana Groundwater Plan (Appendix A) presents recommendations for protecting and remediating groundwater resources and for educating the public about groundwater management. Consequently, this plan will also support groundwater management efforts within the watershed areas described in Chapter 3.

Agriculture

Farms and ranches cover two-thirds of the state—nearly 60 million acres. Thirty percent of this is cropland and sixty-five percent is range and pasture land. Agriculture is Montana's leading industry, generating \$2.3 billion dollars in 1999; \$1.2 billion in crops and \$1.1 billion in livestock. Wheat is by far the leading cash crop, much of it grown in a dryland crop-fallow rotation to conserve moisture. The bulk of the farmland is east of the Rocky Mountains, although there are many important agricultural areas in western Montana.

Agricultural activities impair 6,416 miles of streams and account for 60 percent of nonpoint stream pollution. Over 315,000 lake acres are impacted by farming and ranching. Agriculture pollutants include sediment from range and crop land erosion and streambank destabilization; bacteria and nutrients from livestock manure; fertilizers and pesticides.

The high natural salt content of some Montana soils can lead to the creation of saline seeps or discharge areas. Water, in excess of what can be stored in the annual crop-rooting zone or used by growing crops, dissolves salts in the soil and leaches down to build up a shallow water table on top of the bedrock. The level of the artificially created water table gradually rises until it reaches the soil surface to evaporate and leave a white salt crust. Over time the soil becomes less productive. Salinity has affected more than 300,000 acres of Montana farmland.

Saline ground water, which can be nearly as salty as seawater, also enters rivers, lakes and streams to impair water quality. Thirty-four Montana conservation districts organized the Montana Salinity Control Association (MSCA) to address the problem. Recharge areas, located through ground water investigations, are rotated from annual crop production to deep-rooted perennial crops to gradually lower the static water level and control the saline discharge areas. Numerous federal and state programs provide technical assistance and financial incentives to implement BMPs.

Farmers and ranchers operate in an unstable economic climate. The prices farmers receive for their products fluctuate widely, with broad low valleys between the occasional high peak. Meanwhile, the prices farmers pay for their inputs only seem to go up. Most Montana farmers have had to weather several years of drought and low prices. To stay in business farmers and ranchers have to be conservative fiscal managers. They can't afford to gamble on untested management practices. Only when farmers and ranchers are convinced that they can simultaneously protect water quality *and* long term profitability will we see significant voluntary results. Our challenge is to focus the rancher or farmer's attention, experience and resourcefulness on water quality problems—and to persuade farmers and ranchers to participate in the local watershed planning process. The watershed approach, with its emphasis on local planning and voluntary, proactive involvement, appeals to the agriculture community. The early success of the watershed approach is due to the leadership and cooperation of agriculture producers and their membership organizations. Montana's leading agriculture organizations are represented on the Statewide TMDL Advisory Group and have participated in the development of agriculture best management practices.

DEQ has produced or helped to fund several agriculture BMP publications including **Riparian Grazing Successes on Montana Ranches** (1995), **Guide to Animal Waste Management**

and Water Quality Protection in Montana (1996). The watershed planning process will identify other public information/education needs

WHOLE FARM AND RANCH PLANNING

Individual water quality plans for farms, ranches and small acreages can be a component of an implementation strategy for a watershed plan. Developing a water quality plan enables a landowner to look critically at how his activities impact water quality and helps him integrate best management practices into his overall operation. The water quality plan can, and probably should, be integrated into a whole farm plan that includes business management, crop rotation, animal husbandry, pest and fertility management and wildlife habitat. The water quality component of the plan might address soil erosion, irrigation management and return flows, range management, nutrient management, pesticide use and riparian area protection or restoration. It is not always possible, or even necessary, to separate water quality measures from other components of farm management. For example, reducing soil erosion (a water quality practice) maintains the productivity of the soil and the sustainability of the farm as a business.

Most whole farm plans include goals and targets. A goal is a general statement of purpose or intent. A whole farm goal might be to "sustain the productivity of the soil." Targets are specific and quantifiable: "increase soil organic matter from 1.5 to 2.5 percent;" "establish 1500 feet of riparian forest buffer." A good plan includes a timetable for meeting targets and includes a monitoring strategy for evaluating success. Equipped with some fundamental training from the Montana Volunteer Water Monitoring Project, a landowner can track the health of a stream over time. He can also use other indicators to document progress, such as photo points taken at strategic sites on the farm or ranch. Over time these photos will indicate how the land is responding to alterations of management. *Indicator species* can also be used for gauging the health of the farm ecosystem. The landowner may perform an annual or biennial census of a few wildlife species that demonstrate the land's diversity and vigor.

A whole farm plan doesn't have to be as long and complex as the Plum Creek Habitat Conservation Plan (see page 2-12). Plum Creek's staff includes foresters, soil scientists, wildlife biologists and other experts. However, a family farmer or rancher can utilize the expertise of the local conservation district, Natural Resources Conservation Service, Department of Fish, Wildlife and Parks and other resource agencies.

DEQ has no authority or desire to require farmers and ranchers to develop water quality or whole farm plans. However, for many farmers, ranchers and small landowners, a whole farm plan can be an important tool in meeting their economic and environmental goals. It can also be a tool for local watershed groups to measure progress and achieve targets. Conservation districts and watershed groups could take the lead in providing whole farm plan training to farmers and ranchers. DEQ's role would be to provide resources to local groups and publicize their efforts.

NPS Agriculture Strategy

Success: *Agriculture best management practices identified in water quality restoration plans are implemented within five years of plan approval. Five-year evaluation shows quantifiable progress toward achieving water quality standards and restoring beneficial uses.*

GOAL 1 Increase implementation of agriculture best management practices.

Objective 1.1 Continue to seek the support, trust and collaboration of agriculture producers and their membership organizations.

ACTIONS

A. Develop a 319 contract with the Montana Farm Bureau to fund a director of water quality programs. This Farm Bureau employee will:

- 1) make presentations to agriculture organizations;
 - 2) write articles for farm publications and prepare radio and television stories.
 - 3) help organize watershed groups and encourage farmers and rancher to participate in the watershed planning process;
 - 4) serve as a liaison between agriculture producers and resource agencies;
 - 5) help farmers and ranchers identify potential sources of pollution and help them obtain technical or financial assistance to address water quality problems.
- B. Work with other state and local agriculture organizations to persuade their members to serve on local watershed advisory committees.

Objective 1.2 Promote BMP implementation on a watershed basis

ACTIONS

- A. Encourage watershed groups to take a proactive role in developing water quality targets and setting BMP goals.
- B. Continue to assist and support watershed groups with implementation following plan approval.
- C. Work with watershed groups to develop strategies to promote BMP implementation. This might include articles in local newspapers, public service announcements on television and radio stations and presentations to local farm organizations, as well as one on one contact with farmers and ranchers in the watershed.
- D. Encourage farmers and ranchers to take advantage of low interest State Revolving Fund loans to finance the implementation of best management practices.
- E. Help local watershed groups identify other financial and technical resources for BMP implementation.
- F. Identify agriculture-related public information/education needs.
- G. Salinity from cropland and other land-use practices can sometimes be addressed on an individual basis, but often it requires cooperation within a watershed. The Montana Salinity Control Association, DNRC, NRCS, MBMG and DEQ will assist local watershed groups in setting reduction targets and in identifying appropriate BMPs.
- H. Collaborate with MSU Cooperative Extension Service, NRCS and agriculture organizations in providing resources and training in whole farm planning to farmers, ranchers, conservation districts, watershed groups and other resource agencies.

IRRIGATED AGRICULTURE

There are 2.8 million acres of irrigated farmland in Montana. Three percent of irrigation water comes from groundwater sources and 97 percent from surface waters. During the summer nine million gallons a day are used for irrigation. Irrigation accounts for 97.6 percent of all surface water withdrawals. Important irrigated crops include wheat, alfalfa, barley, oats, sugar beets, potatoes, corn and cherries.

Irrigated crop production impairs over 2000 miles of streams. Many streams are impaired by low stream flows and high water temperatures resulting from irrigation withdrawals. Conversely, other streams have too much water from irrigation return flows. This happens where water is diverted from a large stream and returned to a small one. Fluctuating flows erode stream banks and streambeds and destroys aquatic and terrestrial habitat. Return flows often contain sediment, nutrients, pesticides and other pollutants. Several conservation districts and watershed

groups have had considerable success in restoring water quality by improving irrigation efficiency. For example, replacing an open ditch with a pipe and converting some fields from flood to sprinkler irrigation saved enough water to guarantee late summer stream flows in the Big Creek Watershed in Park County. Historically, there was no incentive for farmers to conserve irrigation water. Water rights doctrine was pretty much "use it or lose it." However, in 1989 the law was amended to allow water rights to be leased for instream uses. The Natural Resources Conservation Service estimates seventy percent of Montana irrigation systems could use improvement in irrigation water management, on-farm irrigation systems, and irrigation water conveyance. Improved irrigation water management not only improves stream flows, it also reduces the amount of sediment, pesticides and nutrients entering Montana's surface water.

For many irrigators, energy for pumping and applying water is a major cost of production. Rapidly rising utility rates will discourage some from investing in best management practices. High rates also dissuade conversion from flood irrigation to more water-efficient sprinkler irrigation. While high rates might encourage less water use, the unstable market might also lead some to sell their land for other uses that might have more severe water quality impacts.

NPS Strategy for Irrigated Agriculture

***Success:** Increased irrigation efficiency and the application of best management practices augments stream flows and improves water quality while increasing profitability for irrigators.*

GOAL 2 Improve irrigation water management

Objective 2.1 In watersheds where irrigated agriculture has a major impact on water quantity and quality, DEQ will help watershed groups identify resources for improving irrigation water management.

ACTIONS

A. Publicize and promote the Bureau of Reclamation's AgriMet <http://www.gp.usbr.gov/agrimet/agrimet.htm> system which provides climatic data and crop water use information to assist farmers in irrigation scheduling and application.

B. Work with conservation districts, watershed groups and agriculture organizations to provide irrigators with information and training on using modern technologies to monitor air and soil temperatures, soil moisture, evaporation, relative humidity, crop water use, and other factors that influence irrigation scheduling.

C. Collaborate with other resource agencies and nonprofit organizations to demonstrate and promote water conserving technologies.

Objective 2.2 Upgrade obsolete and inefficient irrigation delivery systems.

ACTIONS

A. Help watershed groups identify public and private resources for improving irrigation infrastructure.

B. Promote the Pollution Control State Revolving Fund Program which can provide low interest loans to irrigation districts and similar entities.

C. Demonstrate and publicize alternative energy technologies for irrigation pumping and delivery.

GOAL 3 Improve water quality through the increased application of irrigation best management practices

Objective 3.1 Achieve water quality targets by implementing irrigation BMPs identified in water quality restoration plans.

ACTIONS

- A. Work with conservation districts, watershed groups, agriculture organizations and other resource agencies in developing, refining and promoting BMPs for irrigated agriculture.
- B. As part of TMDL planning process, assist watershed groups in estimating potential pollutant reductions from specific BMPs.
- C. Publicize successful projects through public presentations, articles, press releases, videos, tours and other media.

Rangeland

There are three times as many cattle as people in the Big Sky State. Rangeland is the leading agriculture source of NPS pollution. However, most of the sediment, nutrients and other impairments come from a small portion of the land area devoted to range. According to NRCS, 58 percent of Montana rangeland is in good to excellent condition. Only 20 percent of the rangeland experiences sheet and rill erosion while 37 percent of streambanks in range areas experience light to significant erosion.

The Montana Watershed Coordinating Council's Prescribed Grazing Standards Work Group developed a set of best management practices that could be employed by both public and private land managers (see Appendix B). Grazing BMPs work better in combination than as a single practice. There is rarely a "silver bullet" grazing practice that will treat all water quality problems resulting from livestock management. Ultimately the interest and dedication of the land manager/owner is more important than a particular grazing practice. Every ranch has its own set of resource challenges that are best addressed by someone with years of experience observing the land.

NPS Strategy for Rangeland

***Success:** Application of BMPs on rangeland contribute to the success of local watershed restoration plans.*

GOAL 4 Increase BMP implementation on rangeland.

Objective 4.1 Apply BMP audit program to range management on public lands.

ACTIONS

- A. Emulate the successful forestry program (see below) and create interdisciplinary teams that will assess the extent and efficacy of BMP application on rangelands.
- B. Include a range management specialist, a hydrologist, a fisheries biologist, a representative of a conservation organization and a rancher or representative of an agriculture organization on each team.
- C. Use the audits to track progress over time and assess how well BMPs are protecting water quality.
- D. Identify areas in which more effort is needed; i.e. public education, research, etc.
- E. Make the audit program available, on a voluntary basis, to private range owners.

Objective 4.2 Include USFS and BLM grazing leases in DEQ environmental assessment reviews.

ACTIONS

A. Review grazing leases on public lands for effective implementation of BMPs and consistency with state water quality standards.

B. Conduct periodic field inspections of public land grazing allotments to review application and effectiveness of BMPs.

Objective 4.3 Support BMP implementation.

ACTIONS

A. As resources permit, provide technical assistance and grants to private landowners to implement grazing BMPs as part of an approved water quality restoration plan.

B. Focus BMP implementation at those lands that are contributing the most to water quality impairment.

B. Work with DEQ's Technical and Financial Assistance Bureau and other agencies and organizations to develop, demonstrate and publicize alternative stock watering systems (i.e. solar and wind) that support water quality restoration and protection.

Habitat Modification

Habitat modification includes bank erosion, channel incisement, riparian degradation and fish habitat degradation. Riparian and instream fish habitats represent one of the most degraded habitat complexes in the state.

Most healthy streams are lined with a verdant border of trees, shrubs, grasses and forbs. This riparian green zone stabilizes the streambank, diffuses flood waters, shades the stream and creates fish and wildlife habitat. Many bird and mammal species depend on the food, water, shelter, and diversity offered by the green zone. In semi-arid prairie lands a riparian area is like an oasis in late summer. Riparian zones mitigate nonpoint pollution by acting as a *biofilter* to trap sediment and other pollutants in run-off water. Riparian vegetation, such as willows and cottonwoods, extract nutrients from the stream and use them to grow. The trees and shrubs shade and insulate the water, preventing over-heating in summer and deep-freezing in winter.

Riparian benefits are not always recognized and appreciated. There is, however, a growing interest in riparian restoration and preservation. Several local watershed groups have used 319 grants to fund restoration and demonstration projects. It is especially heartening that many school groups learn the value of riparian areas by working on restoration projects. Seven state and federal agencies cooperated in the publication of the **Montana Stream Management Guide**. Other BMP guides also stress the importance of maintaining or rehabilitating healthy, dynamic stream systems and riparian areas.

NPS Strategy for Habitat Modification

Success: *Past habitat modifications are mitigated and water quality is protected from future impacts through the implementation of best management practices.*

GOAL 5 Protect and restore healthy stream systems that support beneficial uses.

Objective 5.1 Discourage unnecessary stream channel alterations and riparian vegetation destruction.

Objective 5.2 Within the context of established human activities, restore habitats as healthy, functional, dynamic systems.

ACTIONS

A. Watershed groups will identify technical, financial, information and education resource needs to implement BMPs for habitat restoration. DEQ will research, discover, demonstrate and disseminate cost-effective techniques for restoring riparian habitats. DEQ will link local watershed groups with other government agencies and private organizations interested in riparian habitat restoration.

B. Increase public awareness of healthy stream systems focusing especially on water users and landowners and managers.

E. Continue to support and promote volunteer community habitat restoration projects.

Resource Extraction

Working mines are regulated with federal and state permits including point source discharge permits. In order to obtain a permit, mine operators now have to post a bond covering liability for cleanup and restoration. However, abandoned and inactive mines are a significant source of nonpoint source pollution in many Montana watersheds. DEQ's Mine Waste Cleanup Bureau has prioritized 300 sites. The bureau's activities focus on two primary site types: 1) inactive mine sites addressed under the Surface Mining Coal and Reclamation Act (SMCRA 1977); these sites are known as abandoned mine sites; 2) mining related sites addressed under the Federal Comprehensive Environmental Responsibility, Compensation, and Liability Act (CERCLA) or the Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA); these sites are known as Superfund sites. Heavy metals and riparian habitat modification are the main adverse water quality impacts from abandoned mines. In developing water quality restoration plans in these watersheds, the water quality planning section will work closely with the Mine Waste Cleanup Bureau. More information about the abandoned mines program can be accessed at <http://deq.state.mt.us/rem/mwc/index.htm>

Much of eastern Montana lies atop coal beds that are potential sources of methane. The coal bed methane industry estimates that almost 10,000 wells might be drilled in Montana over the next ten years. More than half of these wells will be on federal lands, a fifth will be on state land and the remainder on private lands.

Trapped methane is released from a coal bed by lowering the water level of the aquifer. Wells are drilled into the coal seam. The casing is sealed above the coal and reduced water pressure allows the methane to rise through the well casing. Often most the water is discharged on the surface.

Coal bed methane extraction may have several water quality impacts. Increased flows from surface discharge may damage stream beds and destabilize streambanks. Ephemeral or intermittent waterways are especially vulnerable to gullyng. The chemistry of the water is also a concern. The parameters of concern include sodium, iron, manganese, fluoride, chloride, ammonia, silver, aluminum, arsenic, boron, barium, cadmium, copper, mercury, nickel, selenium, lead, strontium, sulfate, zinc, nutrients, Total Dissolved Solids (TDS), the Sodium Adsorption Ratio (SAR), Electrical Conductivity (EC) and Total Suspended Solids (TSS). Salinity is a particular concern. Too much salt in irrigation water can inhibit plant growth and destroy the productivity of the soil. Some ranchers and other landowners are also concerned that

coal bed methane wells will lower the water table and reduce supplies available for irrigation, stock watering and rural homes.

Montana has numeric standards for many of the pollutants found in coal bed methane discharge water. The Department of Environmental Quality is working with Wyoming DEQ to set water quality targets for each stream at the Montana-Wyoming border. The quality of the water entering Montana from Wyoming must meet these targets as well as all other narrative water quality standards. These targets will be used to help establish Total Maximum Daily Load limits for discharges from coal bed methane development or other new point sources and applied to nonpoint sources in the Montana portion of the watershed where water quality indicates the need. These TMDLs will be incorporated into water quality plans that are being developed as a cooperative effort of DEQ, local landowners, interested citizens and other government agencies.

NPS Strategy for Resource Extraction

Success: *Montana contributes energy and minerals to the national economy without degrading water quality.*

Goal 6 Mitigate damage from past mining activities and protect water quality while developing new resources.

Objective 6.1 Mitigate damage from past mining activities.

ACTION

Collaborate closely with the Mine Waste Cleanup Bureau in developing TMDLs and water quality restoration plans for impacted watersheds. Much of the assessment work for specific metals and other pollutants is completed.

Objective 6.2 Protect water quality while developing new mining and energy resources.

ACTIONS

A. Develop and implement a coal bed methane policy for protecting surface and ground water that will include TMDLs for parameters of concern. A draft Environmental Impact Statement will be completed fall 2001.

B. Anticipate future resource extraction in “margin of safety” calculations for TMDLs in watersheds where significant resources development may occur.

Silviculture

There are 22.5 million acres of forestlands in Montana, nearly a quarter of the land area. In 1998 the forest products industry contributed \$420 million to the state's economy. The forest lands of Montana are also the headwaters for many important rivers and streams. These provide some of the west's best fishing as well as water for agriculture, recreation, drinking water and many other uses.

Montana's water quality protection program for forestry relies on a combination of regulatory and voluntary approaches. In 1989 the first statewide Best Management Practices for forestry were adopted. These practices are described and illustrated in the **Forestry BMPs** handbook, a Section 319 funded publication developed by the Department of Natural Resources and Conservation, Montana State University Cooperative Extension and the Montana Logging Association. BMPs are also promoted at industry meetings, workshops and conferences. Each year DNRC and the Montana Logging Association conduct workshops for timber harvest

operators, road builders, private landowners and other interested parties to improve the effectiveness and application of BMPs. On average, about 300 individuals attend these workshops each year. In 1989 the Montana legislature required landowners who were planning to harvest a significant amount of timber to notify the state. Under this law best management practice information is sent to the landowner. Revised forestry best management practices have been developed by the state forestry BMP work group and are listed in Appendix C.

Since 1990 biennial audits have tracked the progress of BMP implementation. These audits show considerable progress in BMP application over the past decade (see Table 2-3). The 2000 audit found that forestry best management practices are correctly applied 96 percent of the time. Four interdisciplinary teams conducted 42 audits on sites that were harvested within the past two years. Each site was at least five acres and located within 200 feet of a stream. Each team included a fisheries biologist, a forester, a hydrologist, a representative of a conservation group, a road engineer, a soil scientist and a forest landowner or logging professional. The audit teams evaluated up to 46 BMPs at each site. The teams concluded that the practices are 98 percent effective in protecting soil and water resources. Forty-three percent of the audited sites had no recorded impacts and 48 percent had only minor or temporary impacts. There were no sites

TABLE 2-3: Comparison of Audit Results 1990-2000

	2000	1998	1996	1994	1992	1990
Application of practices that meet or exceed BMP requirements.	96%	94%	92%	91%	87%	78%
Application of high risk practices that meet or exceed BMP requirements.	92%	84%	81%	79%	72%	53%
Percentage of sites with at least one major departure in BMP application.	9%	17%	27%	37%	43%	61%
Average number of departures in BMP application, per site.	1.4	2	3	3.9	5.6	9
Percentage of practices providing adequate protection.	98%	96%	94%	93%	90%	80%
Percentage of high risk practices providing adequate protection	93%	89%	86%	83%	77%	58%
Percentage of sites having at least major/temporary or minor/prolonged effectiveness departure.	21%	26%	34%	28%	37%	64%
Average number of effectiveness departures per site.	1	1.5	2.3	3	4.6	8

where major or prolonged impacts were observed. Eight "high risk" BMPs were evaluated separately. These practices are considered crucial for protecting water quality. The audits found 92 percent of these BMPs were correctly applied and providing adequate protection. The most impacts were associated with road maintenance and drainage. Although the audit teams scored each of the four major ownership (state, federal, industrial and nonindustrial private landowner) categories separately, there were only a few percentage points difference in their performances.

The 1991 Streamside Management Zone (SMZ) law regulates forest practices in riparian areas. Since 1994, the BMP audits have also evaluated compliance with SMZ. The 2000 audit found SMZ rules were correctly applied 96% of the time. Of 17 departures from the rules, 14 were considered minor and three major. SMZ effectiveness was rated very high--over 99 percent.

Plum Creek Timber, Montana's largest private forest landowner, signed a Habitat Conservation Plan (HCP) agreement with the U.S. Department of Interior in November, 2000. The agreement, which covers 1.5 million acres in western Montana, specifies measures to conserve 17 native fish species, including eight species that are threatened or endangered. The Native Fish HCP adopts a multi-species aquatic ecosystem approach, spanning all watersheds within the project area. All of Plum Creek's land management activities, including timber harvesting, road

building, and land sales are governed by the plan. The HCP will help protect and restore water quality in watersheds where Plum Creek Timber is a major landowner.

In the summer of 2000 2,379 fires burned 947,044 acres in Montana. About one-third of the burned area is moderately to highly vulnerable to erosion and related water quality impacts. Most of the highly vulnerable land is located in five watersheds: Big Hole, Bitterroot, Tongue, South Fork Flathead and Upper Kootenai. The actual water quality impacts of the fires will depend on the severity of run-off events and the extent and effectiveness of mitigation measures. Almost 4000 acres of riparian forest vegetation burned in the fires. However, fire can rejuvenate decadent riparian areas and, over the long run, increase water quality protection. Due to the severity of the burn some riparian areas will need to be replanted.

Following the 2000 fire season DEQ participated in an inter-agency effort to provide post fire information to private landowners to encourage them to take actions to prevent soil erosion and protect water quality.

NPS FORESTRY STRATEGY

***Success:** Montana supports healthy watersheds and a healthy timber industry.*

Goal 7 Reduce water quality impacts associated with forest practices.

Objective 7.1 Address forestry impacts on a watershed basis.

ACTIONS

- A. Work with the Montana Logging Association, DNRC foresters, US Forest Service and private forest landowners to assure industry participation in the watershed planning process.
- B. Integrate forestry BMPs into water quality restoration plans in watersheds where forestry is a significant land use.
- C. Work with resource partners to update and expand **Forestry BMPs** handbook to emphasize problem areas identified by the forestry BMP audits. Make handbook accessible on the web.
- D. Continue to support forestry BMP audit program.
- E. Collaborate with resource partners to develop a research project to evaluate the effectiveness of forestry BMPs in protecting water quality.
- F. Continue to review environmental assessments for timber sales and other significant actions on public lands in Montana. In the coming years, more emphasis will be focused on salvage logging operations.
- G. Develop and disseminate best management practices for harvesting and restoring burned forest lands. Reactivate interagency fire recovery group as needed.
- H. As part of watershed planning process, encourage private forest landowners to develop forestry management plans that include a water quality protection component.

Construction

Construction activities are another source of nonpoint pollution. Erosion of exposed soils increases sediment loads in surface waters. Vehicle traffic may track pollutants (e.g., soil, cement dust, oil and grease, paint, metals) off a construction site onto surface streets where they can be washed into storm drains. Although a temporary impact at a particular site, the cumulative impact in areas of extensive development may be substantial.

Construction activities that disturb more than five acres are covered by a MPDES general discharge permit. Within 100 feet of rivers, lakes and streams construction activities that

disturb an acre or more need a permit. Contractors are required to take measures to protect water quality. The impacts of smaller projects are addressed by voluntary BMPs.

NPS Strategy for Construction

***Success:** Water quality restoration plans anticipate construction-related pollutant loads.*

GOAL 8 Reduce water quality impacts of construction activities.

Objective 8.1 Include construction loads in TMDL calculations.

ACTIONS

A. Watershed planners in areas impacted by extensive development and construction will include construction loads into TMDLs for sediment and/or other pollutants. Pollution from anticipated construction projects will be incorporated into the “margin of safety” calculations for TMDLs.

B. Encourage local watershed groups to look at county landuse policies to determine if they contain a water quality section that includes potential impacts from future development and construction.

Objective 8.2 Encourage the voluntary application of BMPs on small construction projects.

ACTIONS

A. Coordinate with local watershed groups, conservation districts and county planning offices to develop information/education campaigns directed at small construction projects.

B. Encourage the construction industry to participate in local watershed groups and take a proactive role in promoting the voluntary application of BMPs.

C. Assess the need for additional construction BMP educational materials.

Urban Runoff/Storm Sewers

Stormwater runoff from urban and industrial areas is a significant source of pollutants such as oil and grease, pesticides and fertilizers, bacteria, and metals (e.g., lead, copper, zinc). The type and concentration of pollutants in stormwater runoff is highly variable. The frequency and intensity of rain affects the amount of pollutants collected in overland flow, the distance pollutants are transported, and the level of sediment deposition and suspension. The volume and intensity of urban runoff increases with the amount of impervious land cover resulting from paving and construction of streets, parking lots, and buildings. With less retention and increased channeling of stormwater flows and streambank instability, severe streambank erosion often results in streams located in urban areas. In the short term, stormwater pollutants may adversely affect aquatic life and restrict recreational use of a waterbody. Over the long term, stormwater pollutants may impair water quality. Point source stormwater discharges are covered under a general MPDES (Montana Pollutant Discharge Elimination System) permit. Montana’s stormwater treatment design manual is available from the DEQ Water Quality Discharge Permit Section.

NPS Strategy for Stormwater

***Success:** Pollution from stormwater is reduced by a combination of public and private initiatives.*

GOAL 9 Reduce stormwater impacts on water quality.

Objective 9.1 Address stormwater pollution on a watershed basis.

ACTIONS

- A. Include stormwater loads in TMDL development for specific pollutants on a watershed basis.
- B. Include representatives of municipalities and other stormwater dischargers on watershed advisory committees.
- C. Encourage and support local information and education campaigns to reduce the amount of pollutants that homeowners contribute to stormwater.

Land Disposal

Some 300,000 Montanans contribute waste to an estimated 120,000 individual septic systems. A well-maintained septic system in suitable soil does a good job of treating household waste. However, neglected systems or systems in unsuitable soil conditions may be sources of excess nutrients and pathogens. In some areas septic systems are a significant water quality concern. There has been little planning, zoning or infrastructure investment in most of the semi-rural and suburban areas near Montana's major cities and recreation areas such as lakes and ski resorts. Groundwater monitoring in Montana has shown elevated nitrate levels near areas of concentrated septic systems. Nitrate levels above 10mg/L can cause "blue baby syndrome," a condition resulting in decreased blood oxygen in newborn infants.

Several water quality districts and watershed groups are confronting this problem, notably in the Helena Valley, Bitterroot Valley, Missoula Valley, Flathead Lake and Gallatin Valley-Big Sky areas. **The Montana Lake Book**, a 319-funded publication, addresses the topic, as do two MSU Cooperative Extension Service publications **Septic Tank and Drainfield Operation and Maintenance** and **Septic Tanks: Inspecting and Trouble-Shooting** - both available at <http://www.montana.edu/wwwpb/pubs/>

Landfills, particularly unlined facilities, pose a threat to surface and ground water quality. Harmful and toxic substances may leach into the aquifer or surface waters. Twenty-five years ago there were more than 500 landfills and waste dumps in Montana. Most of these have been closed. By 1998 there were 122 licensed solid waste facilities. Thirty-one active and ten inactive waste management facilities are monitored for groundwater quality impacts.

NPS Strategy for Land Disposal

Success: *Impacts of land disposal are reduced by the implementation of water quality restoration plans.*

GOAL 10 Address land disposal impacts on a watershed basis.

Objective 10.1 Incorporate land disposal loads into TMDL calculations.

ACTIONS

- A. Assist local watershed groups in areas where septic systems have been identified as a water quality concern; help these groups develop best management practices for homeowners and small landowners to be incorporated into watershed restoration plans. DEQ will also assist in the development of information and education campaigns.
- B. Encourage local watershed groups, water quality districts, conservation districts and county health departments to follow Gallatin and Lewis & Clark County's lead and conduct an inventory of individual septic systems to determine age, condition and potential water quality impact.
- C. Include sites of waste management facilities and inactive landfills on TMDL GIS maps and databases to facilitate monitoring and planning in these watersheds.

Hydromodification

Hydrologic modification includes flow regulation and straightening, widening, deepening, clearing or relocating existing stream channels.

A healthy stream is dynamic, with room to expand and dissipate energy. While some erosion of stream beds and banks is a natural part of the process, there is a rough equilibrium between the volume of water, gradient of the channel and the amount and size of sediment.

Human activities have greatly altered many stream channels. When streams are straightened they flow faster, with greater erosive power. When a stream is prevented from overflowing its banks onto a flood plain, it must cut deeper into its channel.

Flow regulation and modification affects water temperature, dissolved oxygen, instream flows and streambank stability. Temperature and flows may limit aquatic life and recreational use downstream of the impoundments. Sources of flow modification include dams, weirs for irrigation and stock water, undersized culverts, transportation embankments and reclamation ponds for point source discharges.

Dam construction submerges river, stream, and riparian habitat and blocks fish migration. Reasonable dam operation is defined by law as a “natural” condition. Dam operators have taken actions to mitigate impacts to downstream fish. The Bureau of Reclamation modified Hungry Horse Dam to release warmer water during power generation. This has improved fish habitat 47 miles downstream to Flathead Lake. The Army Corps of Engineers has developed a plan for modifying flow below Fork Peck Dam to improve habitat for pallid sturgeon, an endangered species in the Lower Missouri.

By state law hydroelectric interests are to be included on local watershed advisory committees (where appropriate). The Unified Federal Policy on Watershed Management includes those agencies which operate dams in Montana, i.e. Army Corps of Engineers and Bureau of Reclamation.

Several state and federal laws regulate stream-related activities:

The **Montana Stream Protection Act**, administered by Fish, Wildlife & Parks, applies to any government project that may affect the bed or bank of any stream.

The **Montana Floodplain and Floodway Management Act** applies to new construction within a 100-year floodplain. This act is administered by county-designated local officials and DNRC.

The **Montana Natural Streambed and Land Preservation Act** applies to any private, nongovernmental activity that physically alters or modifies the bed or banks of a perennially flowing stream. It is administered by local conservation districts.

A **Montana Land-use License or Easement on Navigable Waters** is required for any project below the low water mark. The licenses are issued by DNRC.

Section 404 of the **Federal Clean Water Act** applies to any activity that will result in the excavation, discharge or placement of dredged or fill material into waters of the United States. The U.S. Army Corps of Engineers administers the law. EPA has regulatory and enforcement functions.

NPS Strategy for Hydromodification

Success: *Hydromodifications are managed to reduce water quality impairments.*

GOAL 11 Mitigate and reduce impacts of existing hydrologic modifications and assure that new hydromodifications do not impair beneficial uses.

Objective 11.1 Address hydromodification impairments on a statewide and watershed basis.

ACTIONS

- A. Include representatives of hydroelectric interests on local watershed advisory committees.
- B. Work with local watershed groups to develop TMDL targets and identify appropriate BMPs for flow related impairments.
- C. Review permit applications, environmental impact statements and other appropriate documents for compliance with state water quality laws and standards.
- D. When it is determined that hydrological modifications are in the public interest, urge that least-impact approaches be adopted.
- E. Assess the need for additional BMPs for hydromodifications.

Transportation

The state's transportation system contributes to nonpoint source pollution through runoff, atmospheric deposition, flood plain encroachment and construction activities. Chlorides used for melting ice may end up in rivers, lakes and streams. Vehicles release pollutants such as oil and grease, particulate matter and heavy metals (i.e. brake pad asbestos) that are washed into surface waters. Vehicle air pollutants such as nitrous oxides, particulates, lead, and trace levels of other chemical toxins are incorporated into raindrops and deposited into surface waters. Road construction in floodplains and valleys may result in flow constriction at bridges and culverts, soil erosion, and head-cutting thereby increasing a stream's sediment load. Road construction sometimes alters riparian and wetland areas that were protecting water quality. Montana's Department of Transportation works to mitigate wetlands impacts and is using new federal funds to address fish habitat problems.

NPS Strategy for Transportation

***Success:** Transportation related impairments do not exceed TMDL targets.*

GOAL 12 Mitigate past transportation impairments and reduce future impacts.

Objective 12.1 Collaborate with Montana Department of Transportation (MDT) to address transportation impacts.

ACTIONS

- A. The Montana Department of Transportation will fund a TMDL planning position to mitigate past transportation projects and avoid future impairments associated with construction and maintenance activities. Where appropriate, transportation impacts will be addressed in water quality restoration plans.
- B. Finalize Interagency Agreement on Environmental Review with Montana Department of Transportation.

Atmospheric Deposition

The 2000 303(d) list identifies atmospheric deposition as a probable source of impairment for three large lakes and reservoirs: Flathead Lake, Fort Peck Reservoir and Holter Lake. These lakes total over 376,500 acres. Pollutants attributed to atmospheric deposition include nitrogen, mercury and chemicals such as PCBs. Atmospheric deposition is a source of impairment that doesn't lend itself to the watershed approach since sources may be well removed from the affected waterbody. It is a state, regional, national and international challenge that will require coordinated efforts to resolve.

NPS Strategy for Atmospheric Deposition

Success: State and federal governments develop effective policies to curtail water pollution from atmospheric deposition.

GOAL 13 Develop an effective response to atmospheric deposition.

Objective 13.1 Develop a more complete understanding of atmospheric deposition impacts on water quality and recommend appropriate public policies.

ACTIONS

A. Quantify contributions of atmospheric deposition to pollution loads as part of source assessments for TMDL planning.

B. Work with DEQ Air Quality Monitoring Section to characterize and describe atmospheric deposition on impaired water bodies.

C. In watersheds where atmospheric deposition is a significant source of a pollutant, and the specific sources cannot be identified or otherwise included in the plan, other load sources of the pollutant may be reduced to meet TMDL targets.

D. Report water quality impacts of atmospheric deposition to the Board of Environmental Review, the Environmental Quality Council, Environmental Protection Agency and Montana's Congressional delegation.

E. Increase public awareness of the water quality impact and threat of atmospheric deposition through information/education activities.

Contaminated Sediments

Metals and long-lived organic toxic pollutants from past mining-related activities, fuel spills, rail yards, wood treatment and other industrial sources often accumulate in streambeds and lake sediments. These pollutants may be directly toxic to aquatic life and humans or they may be concentrated in tissues of fish and higher animals that feed on aquatic life or fish. Through bioaccumulation, these concentrations can reach levels that are harmful to the health of wildlife and humans.

NPS Strategy for Contaminated Sediments

Contaminated sediments will be addressed on a watershed or waterbody basis. Each source of contamination presents its own set of challenges. Removing and disposing of contaminated sediments is often expensive and creates risks and other water quality impacts, such as dispersion downstream. As appropriate, Remediation Division Resources will be utilized to address clean-up.

Natural Sources

In calculating loading capacities for a TMDL all sources of an impairment are considered including point, nonpoint and natural. Some Montana waters are naturally high in arsenic, nitrate, sediment and sodium. Geothermal sources of arsenic impact the Madison, Yellowstone, and Missouri rivers. Geologic materials in the watershed of the Milk, Powder, and Tongue rivers contribute arsenic to these waterbodies. Nitrate from marine shales in eastern Montana as well as saline seeps in other parts of the state limit the beneficial uses of some surface and ground waters.